

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:  
a semiconductor substrate;

5 a transistor comprising a gate insulation film on  
the semiconductor substrate and a gate electrode on the  
gate insulation film; and

a device isolating insulation film comprising a  
first portion which extends from a surface of the  
semiconductor substrate to an inner part of the  
10 semiconductor substrate and a second portion which  
protrudes from the semiconductor substrate, wherein a  
side surface of the second portion is in direct contact  
with a side surface of the gate electrode at least  
partially and a cross section of the gate electrode is  
15 reverse tapered.

2. The device according to claim 1, wherein the  
gate electrode constitutes at least a portion of a  
floating gate electrode, and the transistor further  
comprising an interlayer gate insulation film on the  
20 floating gate electrode and a control gate electrode on  
the interlayer insulation film.

3. The device according to claim 2, wherein a  
side surface of the first portion on the gate electrode  
side is disposed discontinuously with the side surface  
25 of the second portion on the gate electrode side, and a  
width of the second portion is larger than a width of  
the first portion.

4. The device according to claim 3, wherein a cross section of the second portion is forward tapered.

5        5. The device according to claim 1, wherein a side surface of the first portion on the gate electrode side is disposed discontinuously with the side surface of the second portion on the gate electrode side, and a width of the second portion is larger than a width of the first portion.

10       6. The device according to claim 1, wherein a cross section of the second portion is forward tapered.

7. A method of manufacturing a semiconductor device comprising:

15       forming a laminate structure comprising a gate insulation film on a semiconductor substrate and a gate electrode material film on the gate insulation film;

      processing the gate electrode material film to obtain a gate electrode having a reverse tapered cross section; and

20       forming a device isolating insulation film being in direct contact with a side surface of the gate electrode.

      8. The method according to claim 7 further comprising, after the formation of the device isolating insulation film, removing a portion of the gate electrode to divide the gate electrode into a plurality of portions.

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9. The method according to claim 7, wherein the

processing of the gate electrode material film  
comprises:

5 partially removing each of the semiconductor  
substrate, the gate insulation film and the gate  
electrode material film to obtain a groove, a bottom of  
the groove being constituted by the semiconductor  
substrate and sidewalls of the groove being constituted  
by the semiconductor substrate, the gate insulation  
film and the gate electrode.

10 10. The method according to claim 9, wherein the  
formation of the device isolating insulation film  
comprises:

15 forming a first device isolating insulation film  
on each of the sidewalls such that the first device  
isolating insulation film becomes thinner toward an  
opening of the groove; and

forming a second device isolating insulation film  
in the groove after the formation of the first device  
isolating insulation film.

20 11. The method according to claim 10, wherein the  
first device isolating insulation film is formed by  
means of a deposition method.

25 12. The method according to claim 10, wherein the  
gate electrode is formed by anisotropically etching the  
gate electrode material film.

13. The method according to claim 9, wherein the  
partial removal for obtaining the groove is performed

such that a width of the groove becomes wider toward an opening of the groove.

14. The method according to claim 7, wherein the processing of the gate electrode material film  
5 comprises:

partially removing the gate electrode material film to obtain a groove, a bottom of the groove being constituted by the semiconductor substrate and sidewalls of the groove being constituted by the gate  
10 electrode.

15. The method according to claim 14, wherein the formation of the device isolating insulation film comprises:

forming a first device isolating insulation film  
15 on each of the sidewalls; and

forming a second device isolating insulation film in the groove after formation of the first device isolating insulation film.

16. The method according to claim 15, wherein the  
20 first device isolating insulation film is formed by oxidizing a side surface of the gate electrode.

17. The method according to claim 14, wherein the gate electrode is formed by anisotropically etching the gate electrode material film.

25 18. The method according to claim 15, wherein the formation of the second device isolating insulation film is performed such that a bottom of the second

device isolating insulation film is lower in position than a interface between the gate insulation film and the semiconductor substrate.

19. The method according to claim 14, wherein the  
5 partial removal of the gate electrode material film is performed such that a width of the groove becomes wider toward an opening of the groove.

20. The method according to claim 15, wherein the  
first device isolating insulation film is formed by  
10 means of a deposition method.